



# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference FP-09-0865		FOR FURTHER ACTION	See Form PCT/PEA/416
International application No. PCT/GB2004/003106	International filing date (day/month/year) 16.07.2004	Priority date (day/month/year) 16.07.2003	
International Patent Classification (IPC) or national classification and IPC H05B3/58, H05B3/14, H05B3/64			
Applicant KANTHAL LIMITED et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 2 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 12.02.2005		Date of completion of this report 19.08.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Garcia, J  Telephone No. +49 89 2399-7184 	

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/GB2004/003106

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**Box No. I Basis of the report**

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1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements\* of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-6 as originally filed

**Claims, Numbers**

1-16 received on 12.02.2005 with letter of 10.02.2005

**Drawings, Sheets**

1-4 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-16
	No: Claims	
Inventive step (IS)	Yes: Claims	1-16
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-16
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement

Reference is made to the following documents:

- D1: US-A-4 272 639 (BECK JACOB H) 9 June 1981 (1981-06-09)
- D2: GB-A-1 497 871 (CARBORUNDUM CO) 12 January 1978 (1978-01-12)
- D3: US-A-3 964 943 (ANDERSEN NIELS LERVAD) 22 June 1976 (1976-06-22)
- D4: DE 11 24 166 B (SIEMENS PLANIAWERKE AG) 22 February 1962 (1962-02-22)

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parenthesis applying to this document): A strip-form (helically wound section 22) silicon carbide (see column 6; lines 47-49) furnace heating element.

The subject-matter of claim 1 differs from this known strip-form silicon carbide furnace heating element in that the heating element of the application is extruded with an aspect ratio greater than 3:1, whereas in D1 the heating element is formed by machining a tube of silicon carbide.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as reducing the number of machining operations in the manufacture of a strip-form silicon carbide furnace heating element.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons: By extruding strips of silicon carbide a plastic article results that can be bent to shape and then fired, so reducing the number of machining steps inherent in existing methods of manufacture of silicon carbide. None of the other prior art documents cited in the search report indicate extrusion as a possible manufacturing process for a strip-form silicon carbide furnace heating element.

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REPORT ON PATENTABILITY  
(SEPARATE SHEET)

International application No.

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Claims 2-11 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

Claim 12 discloses the method of manufacture of a new and inventive strip-form silicon carbide furnace heating element by extrusion afterwards bending the strip in order to achieve a desired shape. Therefore claim 12 is also new and inventive.

Claims 13-16 are dependent on claim 12 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

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CLAIMS

1. An extruded strip-form silicon carbide furnace heating element in which the  
5 strip has a cross sectional aspect ratio greater than 3:1.
2. A furnace heating element as claimed in Claim 1, in which the element is non-hollow.
3. A furnace heating element as claimed in Claim 2, in which the cross sectional aspect ratio is greater than 5:1.
- 10 4. A furnace heating element as claimed in Claim 3, in which the cross sectional aspect ratio is greater than 10:1.
5. A furnace heating element as claimed in any one of Claims 1 to 4, in which the element comprises non-strip form cold ends.
6. A furnace heating element as claimed in any one of Claims 1 to 4, in which  
15 portions of the strip have a lowered resistivity and form cold ends.
7. A furnace heating element as claimed in any one of Claims 1 to 6, in which the strip is bent out of the plane of the strip.
8. A furnace heating element as claimed in any one of Claims 1 to 7, in which the strip form element is generally U-shaped.
- 20 9. A furnace heating element as claimed in any one of Claims 1 to 8, in which the strip is curved in cross-section in at least part of its length.
10. A furnace heating element as claimed in any one of Claims 1 to 9, in which the heating section comprises a recrystallised self-bonded silicon carbide material
- 25 11. A furnace heating element as claimed in any one of Claims 1 to 9, in which the heating element comprises reaction bonded or reaction sintered silicon carbide.

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12. A method of making a furnace heating element as claimed in any one of Claims 1 to 11, in which a strip preform is made by extrusion, and is bent to shape after extrusion.
13. A method as claimed in Claim 12, in which cold ends are made separately to the heating section, and later joined to it.
14. A method as claimed in Claim 12, in which cold ends are formed integrally with the element.
15. A method as claimed in any one of Claims 12 to 14, in which the heating section is recrystallised, to form a self-bonded silicon carbide material.
16. A method as claimed in any one of Claims 12 to 14, in which the material of the extruded preform is such that the final product will comprise reaction bonded or reaction sintered silicon carbide.